

Claims

What is claimed is:

- [c1] An electron beam exposure apparatus for exposing a wafer by an electron beam, comprising:
- a general control section for controlling the electron beam exposure apparatus collectively;
 - a first buffer memory for temporarily storing exposure data, which is data of an exposure pattern to be formed on the wafer;
 - a second buffer memory for temporarily storing the exposure data;
 - a first exposure section for applying the electron beam to the wafer based on the exposure data output from said first buffer memory; and
 - a first comparing section for comparing the exposure data output from said first buffer memory with the exposure data output from said second buffer memory, and for notifying the comparison result to said general control section.
- [c2] The electron beam exposure apparatus as claimed in claim 1, wherein
- said first comparing section notifies said general control section whether the exposure data output from said first buffer memory is consistent with the exposure data output from said second buffer memory as the comparison result, and
 - said general control section stores the comparison result in association with an exposure area to be exposed based on the exposure data.
- [c3] The electron beam exposure apparatus as claimed in claim 1, wherein said first comparing section compares the exposure data output from said first buffer memory with the exposure data output from said second buffer memory bit by bit.
- [c4] The electron beam exposure apparatus as claimed in claim 2, further comprising:

- a second exposure section for applying an electron beam to a different wafer from the wafer based on the exposure data output from said first buffer memory;
- a first pattern generation section for generating shot data, which is the exposure data output from said first buffer memory being split into shots;
- a second pattern generation section for generating shot data, which is the exposure data output from said first buffer memory being split into shots; and
- a second comparing section for comparing the shot data output from said first pattern generation section with the shot data output from said second pattern generation section, and for notifying the comparison result to said general control section.

- [c5] The electron beam exposure apparatus as claimed in claim 4, wherein
- said second comparing section notifies said general control section whether the shot data output from said first pattern generation section is consistent with the shot data output from said second pattern generation section as the comparison result, and
 - said general control section stores the comparison result notified from said second comparing section in association with the comparison result notified from said first comparing section.
- [c6] The electron beam exposure apparatus as claimed in claim 1, further comprising a second exposure section for applying an electron beam to the different wafer based on the exposure data output from said second buffer memory.
- [c7] The electron beam exposure apparatus as claimed in claim 6, further comprising:
- a first pattern correction section for correcting the shot data output from said first pattern generation section;

a second pattern correction section for correcting the shot data output from said second pattern generation section; and
a third comparing section for comparing the shot data output from said first pattern correction section with the shot data output from said second pattern correction section, and for notifying the comparison result to said general control section.

[c8] The electron beam exposure apparatus as claimed in claim 7, wherein
said third comparing section notifies said general control section whether the shot data output from said first pattern correction section is consistent with the shot data output from said second pattern correction section as the comparison result, and
said general control section stores the comparison result notified from said third comparing section in association with the comparison result notified from said first comparing section.

[c9] An electron beam exposing method of exposing a wafer by an electron beam, comprising steps of:
writing exposure data, which is data of an exposure pattern to be formed on the wafer, in a first buffer memory;
writing the exposure data in a second buffer memory;
applying the electron beam to the wafer based on the exposure data output from the first buffer memory; and
comparing the exposure data output from the first buffer memory with the exposure data output from the second buffer memory.

[c10] A semiconductor element manufacturing method of exposing a wafer by an electron beam and manufacturing a semiconductor element, comprising steps of:
writing exposure data, which is data of an exposure pattern to be formed on the wafer, in a first buffer memory;

writing the exposure data in a second buffer memory;
applying the electron beam to the wafer based on the exposure data output
from the first buffer memory; and
comparing the exposure data output from the first buffer memory with the
exposure data output from the second buffer memory.

[c11] The semiconductor element manufacturing method as claimed in claim 10, wherein said comparing step comprises a step of outputting whether the exposure data output from the first buffer memory is consistent with the exposure data output from the second buffer memory as the comparison result, and the semiconductor element manufacturing method further comprises a step of storing the comparison result in association with an exposure area to be exposed based on the exposure data.

[c12] The semiconductor element manufacturing method as claimed in claim 11, further comprising steps of:

judging whether the exposure pattern formed to the exposure area is to be inspected based on the comparison result stored in said storage step;
and

inspecting whether the desired exposure pattern is formed on the exposure area based on the judgment result in said judgment step.

[c13] An exposure apparatus for writing a desired exposure pattern to a wafer, comprising:

a buffer memory storing thereon exposure data, which is data of an exposure pattern to be formed on the wafer;

a comparing section for comparing a first exposure data output from said buffer memory based on a first control signal for exposing a first area with a second exposure data output from said buffer memory

based on a second control signal for exposing a second area where the same exposure pattern as the first area is to be written; and an error detection section for detecting an error of the exposure pattern formed to the wafer based on the comparison result by said comparing section.

- [c14] The exposure apparatus as claimed in claim 13, further comprising a first expect memory storing thereon the first exposure data output from said buffer memory, wherein said comparing section compares the first exposure data output from said first expect memory with the second exposure data output from said buffer memory.
- [c15] The exposure apparatus as claimed in claim 14, wherein said comparing section compares the first exposure data output from said first expect memory with the second exposure data output from said buffer memory bit by bit.
- [c16] The exposure apparatus as claimed in claim 14, further comprising a comparison result storing section storing thereon information indicating whether the first exposure data and the second exposure data are the same as each other as a comparison result in association with identification information on the second area, wherein said error detection section detects an error of the exposure pattern formed to the wafer based on the comparison result stored on said comparison result storing section.
- [c17] The exposure apparatus as claimed in claim 16, wherein
said comparing section compares the first exposure data output from said first expect memory with a third exposure data output from said buffer memory based on a third control signal for exposing a third area where the same exposure pattern as the first area is to be written,

said comparison result storing section stores information indicating whether the first exposure data and the second exposure data are the same as each other, and information indicating whether the first exposure data and the third exposure data are the same as each other, as the comparison result, and

said error detection section judges that there is an error in the exposure pattern formed to the third area when the first exposure data and the second exposure data are the same as each other and the first exposure data differs from the third exposure data, and judges that there is an error in the exposure pattern formed to the first area when the first exposure data differs from the second exposure data and the first exposure data differs from the third exposure data.

[c18] The exposure apparatus as claimed in claim 14, further comprising a wafer stage mounting thereon the wafer for exposing the wafer while said wafer stage is moving in a first direction and then changing the direction and moving in a second direction opposite from the first direction, wherein in case that said wafer stage changes the direction, the first exposure data output from said buffer memory is written to said first expect memory.

[c19] The exposure apparatus as claimed in claim 14, further comprising a second expect memory storing thereon the second exposure data output from said buffer memory, wherein said comparing section compares the second exposure data output from said second expect memory with the third exposure data output from said buffer memory based on a third control signal for exposing a third area where the same exposure pattern as the first area is to be written.

[c20] The exposure apparatus as claimed in claim 19, further comprising:
a first expect memory control section for causing the first exposure data to be written to said first expect memory while said buffer memory is

outputting the first exposure data, for causing said comparing section to read the first exposure data from said first expect memory while said buffer memory is outputting the second exposure data, and for causing the third exposure data to be written to said first expect memory while said buffer memory is outputting the third exposure data; and

a second expect memory control section for causing the second exposure data to be written to said second expect memory while said buffer memory is outputting the second exposure data, and for causing said comparing section to read the second exposure data from said second expect memory while said buffer memory is outputting the third exposure data.

[c21] A pattern error detection method of detecting an error of an exposure pattern formed to a wafer, comprising steps of:

exposing the wafer using a first exposure data output from buffer memory based on a first control signal for exposing a first area;
exposing the wafer using a second exposure data output from the buffer memory based on a second control signal for exposing a second area where the same exposure pattern as the first area is to be written;
comparing the first exposure data with the second exposure data; and
detecting the error of the exposure pattern formed to the wafer based on a comparison result in said comparison step.

[c22] An exposure apparatus for writing a desired exposure pattern to a wafer, comprising:

a buffer memory storing thereon exposure data, which is data of the exposure pattern to be formed on the wafer;

an expect data generating section for generating a first expect data, which is an expected value of the exposure data to be output from said buffer memory based on a first control signal for exposing a first area;
a comparing section for comparing a first exposure data output from said buffer memory based on the first control signal with the first expect data generated by said expect data generating section;
an exposure section for exposing the wafer based on the first exposure data output from said buffer memory; and
an error detection section for detecting an error of an exposure pattern formed to the wafer based on a comparison result by said comparing section.

[c23] The exposure apparatus as claimed in claim 22, further comprising a first expect memory storing thereon the first expect data generated by said expect data generating section, wherein said comparing section compares the first expect data output from said first expect memory with the first exposure data output from said buffer memory.

[c24] The exposure apparatus as claimed in claim 23, further comprising a wafer stage mounting thereon the wafer, wherein

said wafer stage moves in a first direction, then changes the direction and moves to a second direction opposite from the first direction,
said exposure section performs first exposure processing on the first area while said wafer stage is moving in the first direction and performs second exposure processing on the first area while said wafer stage is moving in the second direction, and
the first expect data is written to said first expect memory between the first exposure processing and the second exposure processing.

[c25] The exposure apparatus as claimed in claim 23, further comprising a wafer stage mounting thereon the wafer, wherein

said wafer stage moves in a first direction, then changes the direction and moves to a second direction opposite from the first direction,

said exposure section performs second exposure processing on the first area while said wafer stage is moving in the second direction after it has performed first exposure processing on the first area while said wafer stage has been moving in the first direction, and

the first expect data, which is generated by said expect data generating section, is written to said first expect memory during the first exposure processing.

[c26] The exposure apparatus as claimed in claim 25, further comprising a second expect memory storing thereon second expect data to be output from said buffer memory based on a second control signal for exposing a second area, wherein

said wafer stage changes the direction once again to the first direction after it has moved in the second direction,

said exposure section performs third exposure processing on the second area while said wafer stage is moving in the first direction after performing the second exposure processing on the first area while said wafer stage has been moving in the second direction,

said comparing section compares the first expect data output from said first expect memory during the second exposure processing with the first exposure data output from said buffer memory, and

the second expect data, which is generated by said expect data generating section, is written to said second expect memory during the second exposure processing.

[c27] A pattern error detection method of detecting an error of the exposure pattern formed to a wafer, comprising steps of:

generating a first expect data, which is an expected value of exposure data to be output from buffer memory based on a first control signal for exposing a first area;

comparing a first exposure data output from the buffer memory based on the first control signal with the first expect data generated in said expect data generation step;

exposing the wafer based on the first exposure data output from the buffer memory; and

detecting an error of the exposure pattern formed to the wafer based on a comparison result in said comparison step.